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ECONOMIC TRENDS

THE APPLICATION OF MULTIPLIERS IN ANALYZING THE PRINCE EDWARD ISLAND ECONOMY

I. Introduction

The Department of Finance receives requests for provincial economic impact multipliers for a wide variety of economic activities. The purpose of this issue of Economic Trends is to provide a broad understanding of this frequently used concept to help answer these inquiries. Often in order to measure the economic benefits of a proposed project or existing industry it is important to estimate the positive spin-off effects associated with them. Multipliers provide the tool whereby the total effect on the economy can be quantified. The use of multipliers however is a controversial application of economic analysis. This paper reviews the various approaches and uses of some of the available estimates of multipliers for Prince Edward Island.

The second section of this paper discusses the general concept of the circular flow of income and the impact multiplier. The third section of this paper examines the concept of the impact multiplier in the context of a macroeconomic model for a provincial or national economy. In this formulation of the impact multiplier, a change in the level of investment expenditure results in a change in incomes for those directly and indirectly involved with the industry. The fourth section reviews input-output analysis which examines an economy at a disaggregated industry level. An expansion or contraction of an industry has ripple effects through backward and forward linkages with other closely related industries. That interaction also impacts on macroeconomic factors. This section also describes the Statistics Canada input-output tables for Prince Edward Island which are used to quantify the interrelationships between industries. These are used in Statistics Canada's calculation of impact multipliers. The fifth section discusses the limitations of multiplier analysis.

II. The Multiplier Concept

The impact multiplier is generally defined as the change in Gross Domestic Product resulting from a one time change in the level of investment, government, or export expenditure. The concept of the multiplier is intuitively simple. When there is an increase in the level of investment in an area from a new project or from a change in government expenditure, the income of firms and households supplying products and services to the project increases directly. These industries will then expand their own purchases and hire more factors of production, and as a result employment is also likely to increase. This might arise from the employment of construction workers who are engaged in the new investment project. As income rises from the newly hired workers, this then produces higher consumer spending and so additional economic activity is induced in those industries producing consumer goods. The production of these additional consumer products generates further incomes and more consumer spending and therefore more incomes for more workers. This process can continue through several rounds of spending and income generation and so the impact of the project multiplies. The multiplier measures the size of the reaction of the economy to the initial shock.

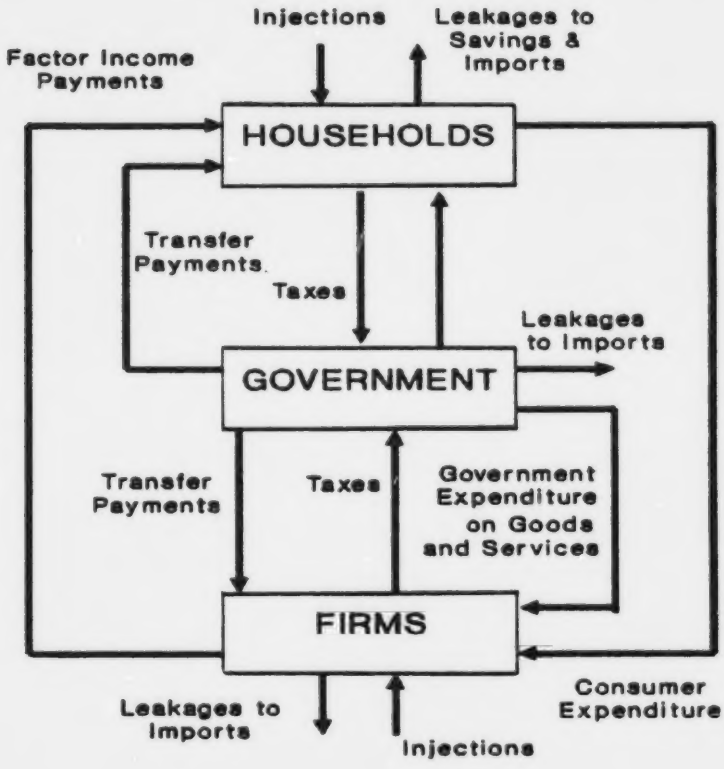
To be expressed as an impact multiplier, this ripple effect from the impact of the initial investment or shock on other industries can be quantified from economic models of the national or local economy. These multipliers can then be used in describing the spin-offs of a particular project or the global impact of an existing industry.

III. Macroeconomic Models

Macroeconomic models attempt to quantify the spending and income flows between households, firms, foreign, and government sectors. Specific industries or firms are not singled out but treated as one sector of the economy. The simplest conceptual representation of the economy on a macroeconomic level is the circular flow of income and expenditure. This outline of the economy is shown in Diagram 1.

Diagram 1

Circular Flow of Income and Expenditure



Shown in Diagram 1 are the money flows of factor income payments from firms to owners of primary inputs such as labour and capital. Household income generates consumer expenditures on goods and services. Households are assumed to be the owners of the primary inputs (labour and capital), and they are the consumers of goods and services. Firms produce these goods and services using the services of the primary inputs supplied by households, and therefore, pay incomes to the households. The government is also part of the system because it collects taxes from both firms and households, and purchases goods and services from firms and households. In turn the government provides services and makes transfer payments, such as Unemployment Insurance, to households.

The model depicts the economy as a circular process whereby household income spent on goods and services again becomes income to households as firms pay factor inputs for services provided. This process would be a continuous flow except for the leakages from these flows. Leakages refer to any proportion of income that is not respent in the local economy but is directed to either savings, purchases of imports or payments of taxes where they are not respent by government in the local economy. As these are not returned to the circular flow of income within the local economy, leakages reduce economic activity. Injections into the circular flow refers to expenditures on goods and services which are not an inherent part of the multiplier interaction. Injections include investment in new plant and equipment, exports, and government spending where it is not offset by tax revenue. The circular flow of income and expenditure achieves an equilibrium when the value of injections to and the value of leakages from the economy, are in balance.

The introduction of a new industry or project is considered an injection into the circular flow of income. This directly increases incomes earned in the industry and thereby local consumption which spreads the increased activity to other sectors. Table 1 describes the impact of a new investment project with a local expenditure of $1 million from either the public or private sector. This has a direct effect on factor incomes which in turn has a further impact from the increase in consumer expenditure that the initial factor payments to households generates. If a constant proportion of income is spent in the local economy, say 50 percent, consumer expenditure on locally produced goods rises by $500,000 as a result of the initial increase in factor income. The remainder of this expenditure is leakages to imports, savings by households, and payments of direct taxes. These leakages from the circular flow of income and expenditure in the local economy result in only part of each round of expenditure returning to local factor incomes. The process continues as factor incomes rise a further $500,000 as a result of the increased sales of locally produced goods. In the third round consumers again spend 50 per cent of this increase in factor incomes, further increasing consumer expenditure by $250,000. This leads to an expansion of incomes greater than the initial $1 million of local expenditure with the sequence of expansion as shown in Table 1.

Table 1: The Multiplier Process

Round of Spending	Increase in Expenditure	Cumulative Total
Initial Expenditure	$1,000,000	$1,000,000
2nd	500,000	1,500,000
3rd	250,000	1,750,000
4th	125,000	1,875,000
5th	62,500	1,937,500
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Total	$2,000,000	$2,000,000

The numerical value for the multiplier is the ratio of the change in income to the initial change in expenditure. In this example the initial increase in expenditure of $1 million leads to an increase in factor incomes of $2 million for an impact multiplier value of 2.

The multiplier process as described above assumes there are enough supplies of factors such as labour, capital, and natural resources to allow the expansion to take place. An increase in expenditure will only have expansionary effects if factor supplies are available and the project does not raise factor prices. In the extreme case where there is no available labour, the project would drive up wage rates in the region causing a reallocation of the existing labour force to the new project, but with no overall increase in employment. These circumstances would clearly limit the multiplier effect.

The impact multiplier can be calculated from national, provincial, or regional economic models. Quantitatively the most significant difference between national and provincial multipliers stems from the leakages to imports. Smaller geographical regions have a heavier reliance on imported goods and consequently their multipliers are smaller. With a higher leakage to imports on each round of spending, less income is retained in the local economy. For a provincial economy such as Prince Edward Island, imports both from other provinces as well as other countries must be taken into account. The proportion of expenditure on locally (provincially) produced goods is lower in each round of spending, resulting in less of an increase in factor incomes in the province. This clearly lowers the value of the multiplier.

A simple impact multiplier estimate for Prince Edward Island was prepared by H. Schwartz in 1977 in the study "The Short-Run Income Multiplier for Prince Edward Island". This calculates an expenditure multiplier using provincial data for the 1960's and early 1970's. The analysis considers the relative importance of transfer payments

to persons in the 1970's, and extends the model to estimate the income multiplier including the effect of the unemployment insurance program. Including the effects of unemployment insurance lowers the value of the income multiplier in this model because an increase in economic activity providing full-time employment is partially offset by reductions in unemployment insurance payments to the province.

Using the data from the 1960's the multiplier was estimated to be <u>at most</u> 1.46 if one excludes the impact of the unemployment insurance program during this time period. Considering the unemployment insurance scheme and adjusting for the tax rates in the 1970's, Schwartz found the income multiplier was in the range 1.27 to 1.33. An investment expenditure of $1 on locally produced goods and services is estimated to increase provincial income by $1.27 to $1.33. Although these estimates are now somewhat dated, they do show that in Prince Edward Island the multiplier effects from a change in investment are not large relative to the initial expenditure.

Another approach has been to construct a provincial macroeconomic model such as presented in F.C. Miller and D.J. Wallace, "The Feasibility of Regionally Differentiated Fiscal Policies: Some Further Results", <u>Canadian Journal of Regional Science</u>, 1983. Miller-Wallace estimated an inter-regional macroeconomic model measuring the impact of development expenditures in Atlantic Canada and Quebec on other provinces. The model includes personal expenditure, investment spending, government expenditure, international trade, and interprovincial trade. The analysis quantifies the impact on all provinces of government expenditure in one individual province. The Miller-Wallace government expenditure impact multiplier results are summarized in Table 2. Each row shows the increase in provincial incomes from a one dollar increase in government expenditure in the province indicated in the left-hand column. For example, a one dollar increase in government expenditure in Prince Edward Island generates, through interprovincial trade and multiplier effects, a $0.0017 increase in income in Newfoundland, $1.1466 in Prince Edward Island, $0.1498 in Nova Scotia, and $0.4313 in Ontario.

Table 2: Miller-Wallace Provincial Multiplier Estimates

Province of initial One Dollar Expenditure	Effect on Gross Provincial Product in:									
	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Nfld.	$0.9266	$0.0070	$0.0456	$0.0268	$0.2197	$0.2912	$0.0103	$0.0087	$0.0251	$0.0117
P.E.I.	$0.0017	$1.1466	$0.1498	$0.0896	$0.3117	$0.4313	$0.0200	$0.0193	$0.0417	$0.0188
N.S.	$0.0010	$0.0046	$0.9472	$0.0295	$0.1410	$0.2355	$0.0138	$0.0129	$0.0268	$0.0096
N.B.	$0.0036	$0.0055	$0.0355	$1.0311	$0.1795	$0.2732	$0.0162	$0.0148	$0.0314	$0.0133
Que.	$0.0024	$0.0012	$0.0067	$0.0076	$1.1525	$0.2494	$0.0168	$0.0124	$0.0466	$0.0118
Ont.	$0.0006	$0.0008	$0.0050	$0.0051	$0.1308	$1.4251	$0.0194	$0.0202	$0.0698	$0.0133
Man.	$0.0004	$0.0004	$0.0042	$0.0032	$0.1174	$0.3237	$1.4404	$0.0792	$0.1151	$0.0388
Sask.	$0.0003	$0.0002	$0.0022	$0.0023	$0.0834	$0.2200	$0.0484	$1.3538	$0.1750	$0.0395
Alta.	$0.0003	$0.0003	$0.0026	$0.0025	$0.1108	$0.2894	$0.0376	$0.0459	$2.0988	$0.0907
B.C.	$0.0002	$0.0002	$0.0024	$0.0022	$0.0794	$0.2054	$0.0167	$0.0120	$0.1549	$1.3926

Source: Miller-Wallace

Miller-Wallace estimate the multiplier value for government expenditure in Prince Edward Island to be 1.1466. Thus, a $1 increase in government expenditure is estimated to create $1.1466 in Gross Domestic Product. The model is estimated from aggregated data on government expenditure and so the specific nature of the expenditure is not specified. This value appears to be low but it is due to the way the government expenditure is measured. The first round effects are less than the full government expenditure because of imports associated with the initial expenditure. Therefore, local income rises initially by less than the government expenditure. Through the multiplier process, incomes on Prince Edward Island rise by $1.1466.

In comparison with the Schwartz multiplier estimate of 1.46, the multiplier values by Miller-Wallace may appear somewhat low. The two estimates may actually be very close as the Miller-Wallace estimate implies that only part of the initial expenditure is realized in household incomes because of leakages to imports in the first round of expenditure. The Schwartz method assumes household incomes increase by the full expenditure. Clearly in undertaking multiplier analysis it is critical to determine the starting point of the multiplier reaction. Miller-Wallace started from the large base of general expenditures so the multiplier measurement will automatically be smaller than that derived from a smaller base, as was the case in the Schwartz study.

A simplified extension of the circular flow model is to disaggregate the regional economy into two sectors: a basic and a non-basic sector. This is known as economic base modelling. The basic sector produces goods and services for sale outside the local economy and thereby creates an income flow into the region.

This income flow is regarded as the fundamental source of growth to the economy. The income flow to the basic sector gives rise to expenditures locally thereby permitting the development of a service or dependent sector. The dependent sector produces goods and services for local consumption and it depends upon the basic sector's well being. This base modelling expresses the multiplier as the size of the total economy divided by the size of the basic sector. It can be useful for analyzing small economies where the ratio of the base to the total is fairly constant.

The macroeconomic multipliers can be useful for measuring the multiplier in general terms. However, such a general analysis may not be suited to specific industrial sectors. The input-output analysis of the next section considers this possibility.

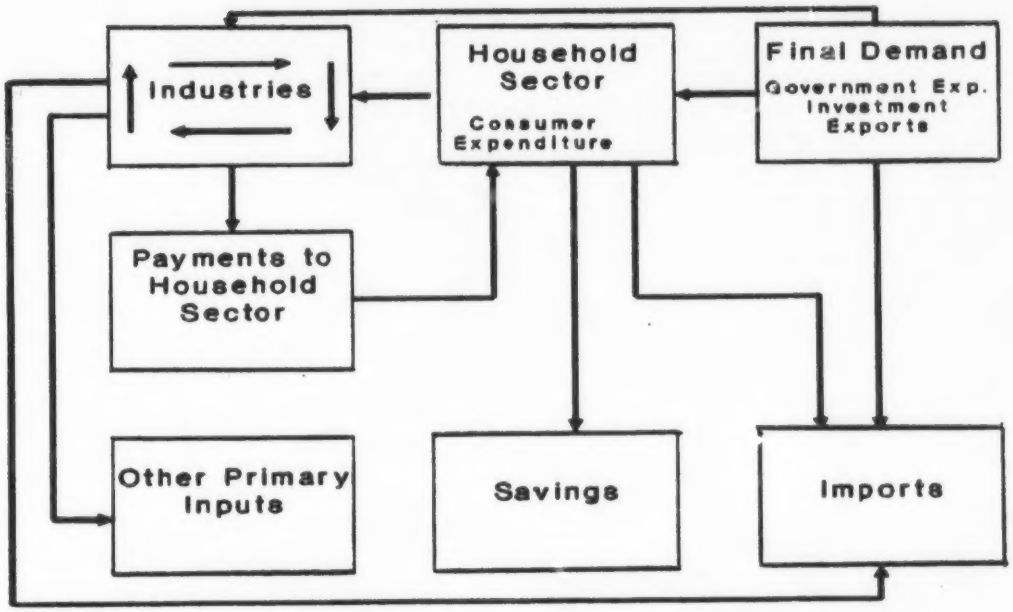
IV. Input-Output Models

Input-output analysis captures the inter-related nature of short-run production by quantifying the value of sales between industries. The models above have dealt with the sectors at a macroeconomic level and have not explicitly stated the microeconomic relationships between industries. The input-output framework identifies for each industry goods and services it purchases from other firms as an intermediate input into its own production of goods. Its outputs sold to other firms become their inputs. For example, an increase in the fishing industry requires inputs such as nets, fuel oil, etc., produced by other industries. As well, the fish processing industry requires fish landings as an input. Input-output is a framework for collecting and relating not only these types of transactions between firms, but also the interaction of households, governments, and foreigners (imports and exports).

Diagram 2 shows in a simplified way the interrelationships between the various sectors in the economy as portrayed in the input-output modelling. For purposes of simplification the interrelationships between government and households and industries have been excluded from this diagram.

Diagram 2

Schematic Diagram of Input-Output Models



The top left box refers to the industry sector. Within the industries sector, which is comparable to firms in the previous circular flow model (Diagram 1), the arrows represent the inter-industry purchases of commodities intermediate in the production of final goods and services. Producing goods and services for the final demand and household sectors also includes the purchase of imports, labour, and other primary inputs. The diagram also identifies the relationship between Final Demand, Households, and Imports. The circular flow aspect of the economy is captured in the input-output model in a similar way to the macroeconomic model. Payments to the household sector are either respent on consumer goods and services, taxed, spent on imports,

or saved. The multiplier effect discussed in the macroeconomic model above is, therefore, incorporated into the input-output model through the feedback of payments to the household sector.

Three effects can take place with the introduction of a project in this model. First, the impacts from expenditures on a specific project include the direct inputs purchased by the project, secondly an indirect impact takes place which includes the impact of inputs purchased by all producing industries supplying inputs to the project, and thirdly, there is the induced impact of the increased income generated by the project which encourages consumer spending and increased employment from the project.

The input-output model described above is said to be closed with respect to the household sector. This follows the format of the Statistics Canada closed model. It is said to be closed with respect to the household sector given that the household income circulates back into the household sector's expenditure stream. Kari Levitt in Input-Output Study of the Atlantic Provinces, 1965., closed the input-output model even more by including the local and provincial levels of government. In this formulation, the increased tax revenues resulting from an increase in the level of economic activity are assumed to be partially respent by the levels of government. The 1965 work was extremely detailed but the data are now somewhat dated. The high level of "closure" also automatically raises the size of the multiplier and this has been subject to criticism. (Kari Levitt has since written a disclaimer on the use of multipliers resulting from the 1965 work.)

The Statistics Canada input-output model is maintained in national input-output tables which are updated each year. A provincial input-output model is constructed every 5 years and 1979 is the latest year for which complete provincial tables are available. The following is a brief description of the data and methodology of the Statistics Canada input-output model. The model is unique in that each industry in the input-output classification may produce more than one commodity, and each commodity may be produced in more than one industry. There are 49 commodities and 16 industries in the Statistics Canada "small version" of the provincial input-output model. Three basic input-output tables are produced for the provinces which characterize each industry's inputs, outputs, and the inter-relationships between industries. A modified version of these matrices are presented in Tables 3, 4, and 5. In Tables 3 and 4, the number of industries was reduced to six for simplicity. This was accomplished by aggregating ten industries into the column headed by "Sum of Remaining Industries". In Table 5, the number of Final Demand categories was reduced to six by aggregating ten Final Demand categories into "Sum of Remaining Demand".

The Make matrix reports the total dollar value of commodity outputs by producing industry. The Make Matrix is displayed with each row representing a commodity and each column an industry. In Table 3, the Make Matrix for Prince Edward Island is displayed for 5 out of the 16 industries.

Table 3: Extract from The Make Matrix Prince Edward Island, 1979, ('000)

		Agriculture	Forestry	Fishing, Hunting	Mines, Quarries	Manufacturing	Sum of Remaining Industries	Total
1	Grains	4,328	0	0	0	0	0	4,328
2	Other Agricultural Products	115,319	0	0	0	0	30	115,349
3	Forestry Products	1,266	45	0	0	0	32	1,343
4	Fishing & Trapping Products	0	0	27,750	0	0	0	27,750
7	Non-Metallic Minerals	0	0	0	0	0	18	18
8	Services Incidental to Mining	0	0	0	57	0	0	57
9	Meat, Fish & Dairy Products	1,029	0	1,861	0	129,203	1,714	133,807
10	Fruit, Veg., Feed, Misc. Food	0	0	0	0	34,366	0	34,633
11	Beverages	0	0	0	0	1,447	4	1,451
13	Rubber, Leather, Plastic Fab	0	0	0	0	263	21	284
14	Textile Products	0	0	0	0	3,512	27	3,539
15	Knitted Products & Clothing	0	0	0	0	627	27	654
16	Lumber, Sawmill, Other Wood	0	0	0	0	6,840	143	6,983
17	Furniture & Fixtures	0	0	0	0	101	6	107
18	Paper & Paper Products	0	0	0	0	2	63	65
19	Printing & Publishing	0	0	0	0	4,393	7	4,400
20	Primary Metal Products	0	0	0	0	218	25	243
21	Metal Fabricated Products	0	0	0	0	3,567	66	3,633
22	Machinery & Equipment	0	0	0	0	3,631	199	3,830
23	Autos,Trucks,Other Transp.Eqp	0	0	0	0	4,706	1,329	6,035
24	Elec. & Communications Prod	0	0	0	0	1,047	1,049	2,096
25	Non-Metallic Mineral Products	0	0	0	0	2,551	17	2,568
26	Petroleum & Coal Products	0	0	0	0	0	23	23
27	Chemicals, Chemical Prod	0	0	0	0	11,180	150	11,330
28	Misc. Manufactured Products	0	0	0	0	2,782	100	2,882
29	Residential Construction	0	0	0	0	0	60,069	60,069
30	Non-Residential Construction	0	0	0	0	0	84,318	84,318
31	Repair Construction	0	0	0	0	0	40,053	40,053
32	Transportation & Storage	0	0	0	0	0	58,190	58,190
33	Communication Services	0	0	0	0	0	28,191	28,191
34	Other Utilities	0	0	0	0	0	33,367	33,367
35	Wholesale Margins	0	0	0	0	12,984	30,615	43,599
36	Retail Margins	0	0	0	0	0	72,996	72,996
37	Imputed Rent Owner Ocpt. Dwel.	0	0	0	0	0	66,400	66,400
38	Other Finance,Ins.,Real Estate	108	0	0	0	92	89,717	89,917
39	Business Services	0	0	0	0	0	27,679	27,679
40	Personal & Other Misc. Service	0	1	158	0	75	110,106	110,340
41	Transportation Margins	0	0	0	0	0	20,800	20,800
42	Operating, Office, Lab & Food	0	0	0	0	0	21,650	21,650
43	Travel, Advertising, Promotion	0	0	0	0	0	12,663	12,663
TOTAL		122,050	46	29,769	57	223,587	762,131	1,137,640

The columns of the Make Matrix show the dollar value of commodity outputs produced by each industry at the head of the column. For example, the Agriculture industry in 1979 produced $4,328,000 of Grains, $115,319,000 in Other Agricultural Products, $1,266,000 in Forestry Products, $1,029,000 in Meat, Fish, and Dairy Products, and $108,000 in Other Finance, Insurance, and Real Estate. Reading by row, the Make Matrix shows the distribution of a commodity output by the producing industry at the head of the column.

The Use Matrix captures the flow of intermediate commodities and primary inputs used by each industry in the production process. An extract from the Use Matrix for Prince Edward Island is displayed in Table 4. Each column shows the purchases, by the industry at the head of the column, of intermediate commodities and primary inputs used in the production of the industry's outputs. For example, the Agriculture industry purchases $792,000 in Grains, $2,581,000 in Other Agricultural Products, $11,000 in Forestry Products and so on. While similar to the format used in the Make Matrix, the Use Matrix also includes payments to primary inputs. The Use and Make matrices are interrelated. Whereas the columns of the Make matrix display the commodity outputs produced by the industry at the head of the column, the columns of the Use Matrix display the commodity inputs purchased by the industry to produce these commodities.

The Final Demand Matrix quantifies the commodity composition of each category of final demand such as consumer expenditure, investment, imports, exports, and government expenditure. Table 5 presents part of the Final Demand Matrix for Prince Edward Island. Reading Table 5 by column shows the purchases of commodities by each category of final demand at the head of the column. For example, under the first column "Consumer Expenditure on Durable Goods", the purchases include $1,502,000 in Rubber, Leather, Plastic Fabricated Products, $1,656,000 in Textile Products, and so on.

The Total column of the Final Demand Matrix, which is the sum of the row entries in the Final Demand Matrix, has negative values for some commodities. This can occur for two reasons. First, imports are a final demand category and this column (not shown) has negative values. Imports supply goods to the provincial market as opposed to most other final demand categories which are demanders of final goods. Therefore, they enter as negative values in the input-output table. Second, changes in inventory (not shown) is also a final demand category. A decline in the level of firm's inventories acts in an opposite manner to a final demand purchase. A reduction of inventories acts as a supply to the provincial market and is therefore indicated by negative values in the Final Demand Matrix.

Table 4: Extract From The Use Matrix, Prince Edward Island, 1979, ('000)

		Agriculture	Forestry	Fishing Hunting	Mines Quarries	Manu-facturing	Sum of Remaining Industries	Total
1	Grains	792	0	0	0	1,621	38	2,451
2	Other Agricultural Products	2,581	0	0	0	51,135	2,429	56,145
3	Forestry Products	11	3	0	0	532	77	623
4	Fishing & Trapping Products	0	0	271	0	25,156	83	25,510
5	Mettalic-Ore & Concentrates	0	0	0	0	0	15	15
6	Minerals Fuels	37	0	0	0	0	59	96
7	Non-Metallic Minerals	135	0	52	0	519	680	1,386
8	Services Incidental to Mining	0	0	0	0	0	535	535
9	Meat, Fish & Dairy Products	86	0	0	0	9,907	7,091	17,084
10	Fruit, Veg., Feed, Misc. Food	12,079	0	0	0	3,409	2,442	17,930
11	Beverages	0	0	0	0	41	374	415
13	Rubber, Leather, Plastic Fab	287	0	0	0	800	4,433	5,520
14	Textile Products	588	0	541	0	1,996	2,004	5,129
15	Knitted Products & Clothing	0	0	0	0	0	165	165
16	Lumber, Sawmill, Other Wood	157	0	215	0	1,848	14,348	16,568
17	Furniture & Fixtures	0	0	0	0	1	219	220
18	Paper & Paper Products	186	0	0	0	5,338	4,520	10,044
19	Printing & Publishing	0	0	0	0	1,428	4,825	6,253
20	Primary Metal Products	0	0	0	2	678	4,254	4,934
21	Metal Fabricated Products	721	0	46	0	7,454	21,024	29,245
22	Machinery & Equipment	933	0	293	1	913	3,995	6,135
23	Autos,Trucks,Other Transp.Eqp	30	0	1,441	0	237	4,900	6,608
24	Elec. & Communications Prod	0	0	617	1	1,979	8,140	10,737
25	Non-Metallic Mineral Products	1,526	0	39	1	1,443	12,288	15,297
26	Petroleum & Coal Products	4,705	2	2,087	3	1,999	21,350	30,146
27	Chemicals, Chemical Prod	12,118	0	37	0	8,273	4,007	24,435
28	Misc. Manufactured Products	0	0	117	0	131	2,553	2,801
31	Repair Construction	3,374	3	886	0	392	19,124	23,776
32	Transportation & Storage	377	3	104	2	789	33,314	34,589
33	Communications Services	598	0	17	0	802	11,887	13,304
34	Other Utilities	1,824	0	12	1	2,706	4,647	9,190
35	Wholesale Margins	3,901	0	509	0	5,129	15,416	24,955
36	Retail Margins	885	0	107	0	53	2,661	3,706
38	Other Finance,Ins.,Real Estate	2,947	2	125	0	2,290	39,521	44,885
39	Business Services	175	0	21	1	1,003	19,078	20,278
40	Personal & Other Misc. Service	412	0	317	1	846	24,394	25,970
41	Transportation Margins	1,890	0	197	0	4,658	4,328	11,073
42	Operating, Office, Lab & Food	3,116	6	507	6	3,900	23,885	31,420
43	Travel, Advertising, Promotion	5	0	0	1	3,840	14,457	18,303
44	Non-Competing Imports	0	0	0	0	0	189	189
45	Unallocated Imports & Exports	0	0	0	0	0	650	650
46	Net Indirect Taxes	-6,657	-2	0	0	-29,998	47,333	10,898
47	Labour Income	12,894	14	222	20	36,944	206,481	260,097
48	Net Income Uninc. Business	36,227	0	14,424	0	619	31,888	83,158
49	Other Operating Surplus	23,111	18	2,820	17	62,776	135,965	224,707
TOTAL		122,051	46	29,768	57	223,587	762,066	1,137,575

Table 5: Extract From The Final Demand Matrix, Prince Edward Island, 1979, ('000)

		Consumer Expend. Durables	Consumer Expend. Semi-Durables	Consumer Expend. Non-Durables	Consumer Expend. Services	Constr. Business	Sum of Remaining Demand	Total
1	Grains	0	0	0	0	0	-2,054	-2,054
2	Other Agricultural Products	0	165	7,068	203	0	53,252	66,688
3	Forestry Products	0	0	1,067	0	0	-343	724
4	Fishing & Trapping Products	0	0	147	0	0	2,091	2,238
5	Metallic Ores & Concentrates	0	0	0	0	0	-15	-15
6	Minerals Fuels	0	0	61	3	0	-160	-96
7	Non-Metallic Minerals	0	21	80	0	0	1,469	-1,386
9	Meat, Fish & Dairy Products	0	0	35,127	0	0	81,593	116,724
10	Fruit, Veg., Feed, Misc. Food	0	0	27,114	0	0	-10,411	16,703
11	Beverages	0	0	12,460	0	0	-11,032	1,428
12	Tobacco & Tobacco Products	0	0	3,553	0	0	-3,553	0
13	Rubber, Leather, Plastic Fab	1,502	5,512	262	0	0	-12,342	-5,066
14	Textile Products	1,656	4,108	355	50	0	-7,715	-1,546
15	Knitted Products & Clothing	0	20,899	0	0	0	-20,741	158
16	Lumber, Sawmill, Other Wood	98	1,041	39	0	0	-10,660	-9,482
17	Furniture & Fixtures	6,828	217	0	0	0	-7,157	-112
18	Paper & Paper Products	0	222	1,701	0	0	-11,902	-9,979
19	Printing & Publishing	0	4,364	0	305	0	-5,873	-1,204
20	Primary Metal Products	0	33	0	0	0	-4,861	-4,828
21	Metal Fabricated Products	463	2,195	105	0	0	-27,719	-24,956
22	Machinery & Equipment	785	406	0	0	0	-3.496	-2,305
23	Autos,Trucks,Other Transp.Eqp	29,694	0	0	0	1,264	-36,008	-5,050
24	Elec. & Communications Prod	9,420	1,049	0	0	0	-19,130	-8,661
25	Non-Metallic Mineral Products	0	1,578	0	0	0	-14,308	-12,730
26	Petroleum & Coal Products	0	12	29,845	318	0	-60,295	-30,120
27	Chemicals, Chemical Prod	117	748	7,688	0	0	-21,562	-13,009
28	Misc. Manufactured Products	5,330	4,323	1,139	72	0	-10,813	51
29	Residential Construction	0	0	0	0	60,069	0	60,069
30	Non-Residential Construction	0	0	0	0	31,295	53,023	84,318
31	Repair Construction	0	0	0	300	0	14,230	14,530
32	Transportation & Storage	0	0	0	18,459	0	6,044	24,503
33	Communications Services	0	0	0	11,104	0	3,602	14,706
34	Other Utilities	0	0	16,297	3,128	0	-9,380	10,045
35	Wholesale Margins	5,653	4,130	14,392	98	121	-5,751	18,643
36	Retail Margins	17,775	23,074	30,456	128	151	2,474	74,058
37	Imputed Rent Owner Ocpt. Dwel.	0	0	0	66,400	0	0	66,400
38	Other Finance,Ins.,Real Estate	0	0	0	48,847	100	-3,914	45,033
39	Business Services	0	0	0	1,600	0	5,801	7,401
40	Personal & Other Misc. Service	9,036	348	0	67,409	0	32,351	109,144
41	Transportation Margins	1,392	1,492	3,464	25	19	3,334	9,726
42	Operating, Office, Lab & Food	0	0	0	1,403	0	9,957	11,360
43	Travel, Advertising, Promotion	0	0	0	1,089	0	5,999	7,088
44	Non-Competing Imports	0	0	1,108	0	0	-1,297	-189
45	Unallocated imports & Exports	0	0	0	-96,294	0	-3,074	-99,368
46	Net Indirect Taxes	10,160	4,378	32,832	3,434	78	4,567	55,449
47	Labour Income	0	0	0	15,944	0	173,662	189,606
49	Other Operating Surplus	0	0	0	1,047	0	29,378	30,425
TOTAL		99,909	80,315	226,360	145,072	93,097	154,323	799,076

These input-output tables are needed to explain the disposition of a commodity for use in the industries in the Use matrix and by final demand categories. More importantly, a series of mathematical transformations of the Make, Use, and Final Demand matrices are made to produce an Impact Matrix, which generate the impact multipliers for each commodity. Table 6 shows three different types of impact multiplier estimates derived by Statistics Canada from the 1979 input-output model for Prince Edward Island for selected industries.

Table 6: Input-Output Multiplier Values
Prince Edward Island, 1979

		Labour Income Multiplier	Gross Domestic Product Multiplier	Employment Multiplier
1	Agriculture	1.50	1.55	1.89
2	Forestry	1.54	1.49	1.47
3	Fishing, Hunting & Trapping	1.42	1.58	4.08
4	Food & Beverage Industries	3.64	2.73	1.91
5	Leather Industries	1.63	1.43	1.13
6	Textile Industries	1.56	1.49	1.44
7	Wood Industries	1.53	1.89	1.24
8	Furniture & Fixture Industries	1.56	1.22	1.11
9	Printing & Publishing	1.49	2.29	1.42
10	Metal Fabricating Industries	1.39	2.20	2.19
11	Machinery Industries	1.57	1.47	1.57
12	Transportation Equipment Ind.	1.43	1.49	1.20
13	Non-Metallic Mineral Products	1.48	1.70	1.70
14	Chemical & Chemical Products	2.27	1.95	1.72
15	Misc Manufacturing Industries	1.63	1.35	1.26
16	Construction Industry	1.51	1.72	1.53
17	Transportation & Storage	1.63	1.62	1.66
18	Communication	1.50	1.63	1.62
19	Elec Power, Gas, Other Util.	1.60	1.17	1.43
20	Wholesale Trade	1.48	1.56	1.38
21	Retail Trade	1.45	1.59	1.51
22	Other Finance, Ins. & Real Est.	1.81	1.58	1.98
23	Education & Health Services	1.41	1.63	2.17
24	Amusement & Recreation Service	1.94	1.75	1.94
25	Services to Business Management	1.77	1.55	1.27
26	Accommodation & Food Services	1.56	1.69	1.30
27	Other Personal & Misc Services	1.41	1.57	1.31

The first column displays the labour income multipliers. These show the total direct and indirect labour income generated in Prince Edward Island per dollar of direct income created by the industry or project. Reading from the first row of Table 6, a $1 increase in direct income generated in the agriculture

industry will create $1.50 in total labour income. Gross Domestic Product multipliers in the second column identify the total direct and indirect Gross Domestic Product generated on the Island per dollar of direct income created by the industry or project. Employment multipliers in the last column calculate the total direct and indirect employment created by the industry per person employed in the industry. These multipliers capture only the spin-off effects that occur within Prince Edward Island and do not include the benefit other provinces receive from the economic activity on the Island.

The size of the multiplier differs for each industry. The main economic reason for this is the industry's direct local expenditure will determine most of the impact. As discussed above, a higher proportion of local expenditure in the first round increases the value of the multiplier. With a high leakage of provincial expenditure to interprovincial and international imports, the subsequent rounds of expenditure contribute a smaller overall impact.

V. Shortcomings

The shortcomings of multipliers are that they tend to oversimplify the economic situation. First, all factor inputs are assumed to be in excess supply and available to facilitate expansion in economic activity without upward pressure on factor prices. If a factor is in short supply then the process of expansion takes a different pattern as scarce resources must be drawn from other activities. Second, the interrelationships between production processes are assumed to be constant regardless of the quantity of output produced. Large changes in the structure of the economy are assumed to result in a scaling up of the economy without any fundamental changes in economic structure. New plants or a completely new industry may result in a change in the value of the impact multiplier for an industry. This would not be captured ordinarily. Finally, the input-output tables are published with a considerable lag so the applicability of the multipliers depends upon their stability over time. Any change in technology can alter the coefficient values in the input-output impact matrix and therefore, the multipliers.

Input-output analysis assumes that the project to be undertaken will use the same technology and factor inputs as the existing firms in the model. This is probably the most error prone aspect of the multiplier, particularly for the first round effects. It is important that more information be available to the analyst regarding local sourcing of inputs. This allows the analyst to better establish the initial effects of the project and thus better quantify its specific effects. Where the import content of subsequent activity is very high, as in the case of

Prince Edward Island, most of the economic benefits occur in the first few rounds of spending and therefore, research efforts directed to the initial impact are most important.

VI. Concluding Comments

Multipliers are just one tool amongst many types of economic tools to be considered for a complete analysis of a project. In the choice of a multiplier estimate, the numerical value can vary widely according to the type of economic model chosen to estimate the impacts.

The above analysis suggests that the application of multiplier analysis depends upon the context of the study. When discussing spin-off effects of a general nature the general macroeconomic multipliers are most relevant. Since an industry is not specified, the macroeconomic model can be used to compute an average value. In the case of specific industrial activity then the input-output tables provide a more precise evaluation of a change in the level of economic activity. As the methodologies are very different in their data sources and model construction, this does not imply that the multiplier values will necessarily be the same nor comparable.

Investment projects often seek public support and are justified by the broader economic benefits expected from the new project. However, the multiplier is based on strict assumptions. Perhaps most fundamental, this form of analysis says nothing about the viability of the project itself. Factors such as resource availability and cost competitiveness are essentially outside the scope of multiplier analysis. The spin-off effects are relevant only when it may be important to understand the macroeconomic implications of an event for the provincial economy.

The multiplier estimates for Prince Edward Island from a variety of sources shows that the spin-off effects are not large relative to the initial change in income. The Statistics Canada input-output model provides a set of multiplier estimates by which various projects can be considered on a consistent basis. This modelling is under continuous development and estimates for 1984 will soon be available.

The above discussion attempts to present an overview of multiplier analysis and does not pretend to provide a complete discussion of this complex subject. A thorough description of the Canadian Input-Output model can be found in The Input-Output Structure of the Canadian Economy, Statistics Canada, Catalogue No. 15-510. Hopefully this issue of Economic Trends provides

some insights on the usefulness of multiplier analysis for analyzing the Prince Edward Island economy for those interested in this form of analysis.